

Creating Research-Based Design Principles for Interdisciplinary Learning

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Abstract: Over the last decade, the focus of K-12 and higher education has shifted significantly from disciplinary curricula to diverse interdisciplinary learning options. This has raised new questions about how people learn across disciplines. One of the biggest concerns is that interdisciplinary courses lack robust theoretical and pedagogical grounding, and research that informs design is particularly needed. However, such research requires bringing a range of different conceptual, pedagogical, and methodological ideas together. The main aim of this workshop is to articulate foundational ideas and methods for creating research-based design principles for interdisciplinary learning. It brings two main audiences: 1) those who are interested in the substantial questions of interdisciplinary learning, and 2) those who are interested in the methodological questions of creating research-based actionable knowledge for design. Workshop participants will work together on producing recommendations on creating research-based design principles for interdisciplinary learning.

Keywords: interdisciplinary learning, knowledge co-creation, research-based design, design principles, K-12, higher education

Organizers

The organizing team of this workshop includes researchers from three continents who have expertise in a range of theoretical and methodological approaches for researching knowledge co-creation across disciplinary boundaries and experience designing interdisciplinary courses. The team co-organized two preceding workshops on interdisciplinary learning at the CSCL2019 and ICLS2020 (Markauskaite et al., 2019, 2020).

- Lina Markauskaite is a Professor of Learning Sciences at The University of Sydney, Australia. Her research focuses on knowledge work and learning across disciplinary and professional boundaries in higher education.
- Crina Damşa is an Associate Professor in the Department of Education, University of Oslo, Norway, and Member of the ISLS Education Committee. Her research focuses on collaborative learning, design for learning, and digital learning environments in higher education.
- Hanni Muukkonen is a Professor in Educational Psychology in the Faculty of Education, University of Oulu, Finland. Her research focuses on collaborative knowledge creation, learning knowledge work practices in higher and secondary education, and learning analytics.
- Peter Reimann is a Professor of Education at The University of Sydney, Australia. His research in CSCL addresses questions of group awareness, design of learning environments, and methodological topics, such as analysis of temporal data.
- Kate Thompson is an Associate Professor of Digital Pedagogies at Queensland University of Technology, Australia. Kate's research explores interdisciplinary learning in professional teams (e.g., scientists, research-practice partnerships), as well as school and tertiary education contexts (e.g., STEAM studios, maker spaces).
- Adam Papendieck is a Lecturer and Writer in Residence at The University of Texas at Austin. Adam's research focuses on digital participatory learning, design for learning, and technology innovation values and practices.

Theme and goals

Over the last decade, the focus of K-12 and higher education has shifted significantly from disciplinary learning to diverse interdisciplinary options. For example, K-12 curriculums increasingly include cross-curricular themes, such as sustainability, and emphasize project-based learning, such as phenomenon-based learning, STEM, and STEAM (Katz-Buonincontro, 2018; Lonka, 2018; Takeuchi et al., 2020). Similarly, universities increasingly offer diverse interdisciplinary learning options, which range from interdisciplinary degrees and specializations (e.g., nanosciences, health technologies) to project-based interdisciplinary courses and tasks (DeZure, 2017; Lyall et al., 2015).

Despite this proliferation of interdisciplinary learning, there has been a significant concern that designs of interdisciplinary courses lack robust theoretical and pedagogical foundations (Katz-Buonincontro, 2018; Lyall et al., 2015). The learning sciences have vast potential to inform design for interdisciplinary learning, but research in this area is just emerging (Kidron & Kali, 2015; Markauskaite et al., 2020a; Pennington, 2016; Smirnov, Easterday, & Gerber, 2018).

The goal of the workshop is to articulate foundational ideas and methods for creating research-based design principles for interdisciplinary learning. This stems from the need to build principled knowledge about productive interdisciplinary designs purposefully, systematically, and cumulatively. Specific objectives are:

1. To share foundational ideas and methods that can inform research-based design for interdisciplinary learning;
2. To synthesize emerging research and methods for constructing design principles for interdisciplinary learning;
3. To sketch recommendations for design and research in interdisciplinary learning and by this to contribute to the systematic development of research-based design principles.

Theoretical background and relevance to the field

Interdisciplinary work requires the capabilities to co-create knowledge together with people who have different expertise and who do not share the same disciplinary vocabularies, epistemic practices, and cultures (Boix-Mansilla, 2017; Cooke & Hilton, 2015). How those capabilities are learned and how to facilitate their development are two broad questions that delineate the scope of interdisciplinary learning.

Interdisciplinary learning is seen as a challenge for a range of reasons. Some of these challenges are general, related to collaboration, such as effective project-based teamwork. However, some of the challenges are specific to the nature of interdisciplinary knowledge work, such as the need to integrate knowledge and ways of knowing from different disciplines and epistemic cultures (Boix-Mansilla, 2017; Cooke & Hilton, 2015; Repko & Szostak, 2016). Further, interdisciplinary learning does not fit easily into the existing discipline-based organizational structures and involves significant design challenges at the institutional levels (Holley, 2017; Klein, 2009).

The learning sciences community has developed a broad conceptual ‘toolkit’ that informs design for collaborative learning (Moen, Morch, & Paavola, 2012; Scardamalia, & Bereiter, 2015; Stahl, 2006). It also has made significant progress in advancing the understanding of learning across diverse epistemic boundaries (Derry, Schunn, & Gernsbacher, 2005; Markauskaite & Goodyear, 2017; Muukkonen et al., 2020). Simultaneously, a range of methods suitable for designing and researching educational innovations in authentic settings and building research-based actionable design principles have been proposed (Bereiter, 2013; Penuel, 2019; Sandoval, 2013). These conceptual and methodological ideas now need to be brought together and resituated in interdisciplinary design and research contexts.

Earlier work and link to the conference

This workshop builds on extends CSCL2019 and ICLS2020 workshops “Theories and methods for researching interdisciplinary learning” (Markauskaite et al., 2019) and “Researching the ecologies of interdisciplinary learning” (Markauskaite et al., 2020).

The outcome of the first workshop was a mapping of different theoretical perspectives and methods for researching various aspects of interdisciplinary learning. It led to a joint realization that interdisciplinary learning cannot be understood by looking only at students’ learning outcomes and processes but requires studying much broader activity systems: from institutional arrangements and cultural practices working with knowledge to diverse personal resources that students bring to interdisciplinary learning settings.

The second workshop, therefore, focused on four broad levels of the ecologies of interdisciplinary learning: 1) institutional arrangements and cultures, 2) curriculum activity systems, 3) interdisciplinary group work, and 4) personal resourcefulness. The workshop resulted in the identification of a set of issues associated

with each level and a need to create stronger connections between the research of interdisciplinary learning and actionable knowledge for design (Markauskaite et al., 2021/submitted).

This ISLS2021's workshop, therefore, focuses on the creation of research-based design principles for interdisciplinary learning. It draws on the earlier articulated framework and identified issues within and across the levels of interdisciplinary learning ecologies.

The workshop brings together two main audiences: 1) those who are interested in the substantial questions of interdisciplinary learning (cognitive, epistemological, social, technological, pedagogical, etc.), and 2) those who are interested in the methodological questions of creating research-based actionable knowledge for design in interdisciplinary learning contexts (equitable approaches in design research, design for scalability, etc.).

In line with the ISLS2021 theme "Reflecting the Past and Embracing the Future," the participants in this workshop will share, embrace and extend diverse foundational ideas and methods for creating research-based design principles to advance the field of interdisciplinary learning.

Expected outcomes and contributions

The expected outcomes range from immediate to long-term benefits:

1. *Immediate*: The workshop participants will expand their understanding of how research in the learning sciences could contribute principled design knowledge for interdisciplinary learning and broaden their international networks.
2. *Short term*: The workshop report with recommendations on creating research-based design principles for interdisciplinary learning will enable more systematic and cumulative work in this emerging research area.
3. *Medium-term*: Workshop outcomes will contribute to a planned special issue of a journal on interdisciplinary learning.
4. *Long-term*: This work will promote the ongoing development of a research knowledge-base for interdisciplinary learning.

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